WHAT IS CLAIMED IS:

1. A magnetic detecting element comprising:

a multilayer film comprising a laminate of a free magnetic layer, a nonmagnetic material layer, a pinned magnetic layer and an antiferromagnetic layer;

wherein a current flows perpendicularly to the film plane of each of the layers of the multilayer film, and the free magnetic layer comprises a plurality of magnetic layers which are laminated through a current limiting layer containing an insulating portion and a conductive portion.

2. A magnetic detecting element comprising:

a multilayer film comprising an upper nonmagnetic material layer, an upper pinned magnetic layer and an upper antiferromagnetic layer, which are laminated above a free magnetic layer, and a lower nonmagnetic material layer, a lower pinned magnetic layer and a lower antiferromagnetic layer, which are laminated below the free magnetic layer;

wherein a current flows perpendicularly to the film plane of each of the layers of the multilayer film, and the free magnetic layer comprises a plurality of magnetic layers which are laminated through a current limiting layer containing an insulating portion and a conductive portion.

3. A magnetic detecting element according to claim 1 or 2, further comprising hard bias layers formed on both sides of the free magnetic layer in the track width direction, for

aligning magnetization of the free magnetic layer.

4. A magnetic detecting element according to claim 1 or 2, further comprising an in-stack bias layer laminated above and/or below the free magnetic layer, for aligning magnetization of the free magnetic layer.

5. A magnetic detecting element according to claim 1, wherein magnetizations of the plurality of magnetic layers are parallel to each other.

6. A magnetic detecting element according to claim 5, wherein the plurality of magnetic layers are ferromagnetically coupled with each other through the current limiting layer.

7. A magnetic detecting element according to claim 1, wherein magnetizations of the plurality of the magnetic layers are antiparallel to each other.

8. A magnetic detecting element according to claim 1, wherein the plurality of the magnetic layers constituting the free magnetic layer have a same magnetic moment per unit area.

9. A magnetic detecting element according to claim 1, wherein the plurality of the magnetic layers constituting the free magnetic layer have different magnetic moments per unit area.

10. A magnetic detecting element according to claim 1, wherein the plurality of the magnetic layers constituting the free magnetic layer have a same thickness.

11. A magnetic detecting element according to claim 1, wherein the plurality of the magnetic layers constituting the free magnetic layer have different thicknesses.

12. A magnetic detecting element according to claim 7, wherein the free magnetic layer comprises a nonmagnetic intermediate layer composed of at least one nonmagnetic material of Ru, Rh, Ir, Os, Re, Cr, and Cu.

13. A magnetic detecting element comprising:

a multilayer film comprising a laminate of a free magnetic layer, a nonmagnetic material layer, a pinned magnetic layer and an antiferromagnetic layer;

wherein a current flows perpendicularly to the film plane of each of the layers of the multilayer film, and a current limiting layer containing an insulating portion and a conductive portion is interposed between the free magnetic layer and the nonmagnetic material layer.

14. A magnetic detecting element comprising:

a multilayer film comprising an upper nonmagnetic material layer, an upper pinned magnetic layer and an upper antiferromagnetic layer, which are laminated above a free

magnetic layer, and a lower nonmagnetic material layer, a lower pinned magnetic layer and a lower antiferromagnetic layer, which are laminated below the free magnetic layer;

wherein a current flows perpendicularly to the film plane of each of the layers of the multilayer film, and a current limiting layer containing an insulating portion and a conductive portion is interposed between the free magnetic layer and one of the nonmagnetic material layers.

15. A magnetic detecting element according to claim 13, further comprising a noble metal material layer formed at one or both of the top and bottom of the current limiting layer.

16. A magnetic detecting element according to claim 15, wherein the noble metal material layer comprises at least one noble metal material of Ru, Pt, Au, Rh, Ir, Pd, Os and Re.

17. A magnetic detecting element according to claim 15, wherein a Cu layer is formed instead of the noble metal material layer.

18. A magnetic detecting element according to claim 13, wherein the insulating portion of the current limiting layer comprises an insulating material film having a plurality of holes extending from the top to the bottom of the current limiting layer, the holes being filled with a conductive material film serving as the conductive portion.

19. A magnetic detecting element according to claim 13, wherein the insulating portion of the current limiting layer comprises an insulating material film having a groove continuously extending in a plan view parallel to the film plane and extending from the top to the bottom of the current limiting layer, the groove being filled with a conductive material film serving as the conductive portion.

20. A magnetic detecting element according to claim 13, wherein the insulating portion of the current limiting layer comprises an insulating material film containing a hole extending from the top to the bottom of the current limiting layer and a groove which continuously extends in a plan view parallel to the film plane and extends from the top to the bottom of the current limiting layer, the hole and groove being filled with a conductive material film serving as the conductive portion.

21. A magnetic detecting element according to claim 20, wherein the insulating material film comprises an oxide film or nitride film.

22. A magnetic detecting element according to claim 13, wherein the conductive portion of the current limiting layer comprises conductive particles which are dispersed in an insulating material layer serving as the insulating portion.

23. A magnetic detecting element according to claim 13,

wherein the insulating portion of the current limiting layer comprises insulating particles which are dispersed in a conductive material film serving as the conductive portion.

24. A method of manufacturing a magnetic detecting element comprising the steps of:

(a) laminating a first electrode layer, an antiferromagnetic layer, a pinned magnetic layer, a nonmagnetic material layer, a first magnetic layer constituting a free magnetic layer, and a current limiting layer containing an insulating portion and a conductive portion in that order from below;

(b) laminating a second magnetic layer constituting the free magnetic layer on the current limiting layer; and

(c) laminating a second electrode layer.

25. A method of manufacturing a magnetic detecting element according to claim 24, wherein the first and second magnetic layers constituting the free magnetic layer are ferromagnetically coupled with each other through the current limiting layer.

26. A method of manufacturing a magnetic detecting element according to claim 24, wherein the first and second magnetic layers constituting the free magnetic layer preferably have a same magnetic moment per unit area.

27. A method of manufacturing a magnetic detecting

element according to claim 24, wherein the first and second magnetic layers constituting the free magnetic layer have different magnetic moments per unit area.

28. A method of manufacturing a magnetic detecting element according to claim 24, wherein the first and second magnetic layers constituting the free magnetic layer preferably have a same thickness.

29. A method of manufacturing a magnetic detecting element according to claim 24, wherein the first and second magnetic layers constituting the free magnetic layer have different thicknesses.

30. A method of manufacturing a magnetic detecting element according to claim 24, further comprising, between the steps (b) and (c), (d) a step of laminating a nonmagnetic material layer, a pinned magnetic layer and an antiferromagnetic layer on the free magnetic layer.

31. A method of manufacturing a magnetic detecting element according to claim 30, wherein only one time of magnetic field annealing is performed after the step (d).

32. A method of manufacturing a magnetic detecting element according to claim 31, wherein a nonmagnetic intermediate layer comprising at least one nonmagnetic material of Ru, Rh, Ir, Os, Re, Cr and Cu is formed in the

first or second magnetic layer in the step (a) or (b).

33. A method of manufacturing a magnetic detecting element according to claim 30, wherein first magnetic field annealing is performed between the steps (a) and (b) or between the steps (b) and (d), and then second magnetic field annealing is performed in a magnetic field of a strength different from that in the first magnetic field annealing and/or in a direction different from that in the first magnetic field annealing after the step (d).

34. A method of manufacturing a magnetic detecting element comprising the steps of:

(e) laminating a first electrode layer, an antiferromagnetic layer, a pinned magnetic layer, a nonmagnetic material layer, and a current limiting layer containing an insulating portion and a conductive portion in that order from below;

(f) laminating a free magnetic layer on the current limiting layer; and

(g) laminating a second electrode layer.

35. A method of manufacturing a magnetic detecting element according to claim 34, further comprising, between the steps (f) and (g), (h) a step of laminating a nonmagnetic material layer, a pinned magnetic layer and an antiferromagnetic layer on the free magnetic layer.

36. A method of manufacturing a magnetic detecting element according to claim 34, wherein the step of forming the current limiting layer comprising the steps of:

(a1) depositing an insulating material film having a plurality of holes extending from the top to the bottom or a groove continuously extending in a plane view parallel to the film plane; and

(a2) depositing a conductive material film on the insulating material film by sputtering to fill the holes or groove formed in the insulating material film with the conductive material film.

37. A method of manufacturing a magnetic detecting element according to claim 36, wherein the insulating material film is formed in a discontinuous film.

38. A method of manufacturing a magnetic detecting element according to claim 34, wherein a target composed of an insulating material and a target composed of a conductive material are prepared, and then the two targets are sputtered to form a current limiting layer containing particles of the insulating material and particles of the conductive material.

39. A method of manufacturing a magnetic detecting element according to claim 34, wherein a noble metal material layer composed of a noble metal element or a Cu layer composed of Cu is formed on the first magnetic layer or the free magnetic layer in the step (a), and then the current

limiting layer is formed on the noble metal material layer or the Cu layer.

40. A method of manufacturing a magnetic detecting element according to claim 34, wherein a noble metal material layer composed of a noble metal element or a Cu layer composed of Cu is formed on the current limiting layer after the current limiting layer is formed.

41. A method of manufacturing a magnetic detecting element according to claim 40, wherein the noble metal material is at least one of Ru, Pt, Au, Rh, Ir, Pd, Os, and Re.